

Zero Retries issue 0206 2025-06-13

Zero Retries is an independent newsletter promoting technological innovation in and adjacent to Amateur Radio, and Amateur Radio as (literally) a license to experiment with and learn about radio technology. Radios are computers - with antennas! Now in its fourth year of publication, with 2800+ subscribers.

About Zero Retries

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Request To Send

Commentary by Editor Steve Stroh N8GNJ

Too Long For Email?

I decided to put a quick indicator under the URL for each issue at the top of the newsletter:

Substack says "Too long for email"? YES

That's the indicator that if you're reading this issue of Zero Retries on a tablet or phone, it's probably best to just go to the web version, as your email app will probably cut off that issue of Zero Retries.

Almost always, the answer will be Yes. 😊 I pack a lot of... *probably too much* content into most issues.

#

Zero Retries Will Publish on Substack Through Late 2025

There are a substantial number of Zero Retries readers that *love* Zero Retries, but *hate* that it's published on the Substack platform.

I first discussed this issue in **Zero Retries** 0133 in 2024-01-05 - The Substack Problem. At that time I became aware of the issue, but I was undecided on what to do. A few weeks later in **Zero Retries** 0135 - Update on The Substack Problem I had decided to move Zero Retries off Substack by the end of 2024. That date came and went, and I set, and missed, a few more goal dates. My most recent goal date for moving Zero Retries off Substack was to coincide with the beginning of Zero Retries' fifth year - **Zero Retries** 0210 on July 11, 2025.

TL:DR - The "move Zero Retries off Substack" date has been extended into late 2025. Read on for the backstory of why we made that difficult decision.

Much like Zero Retries has grown beyond the simple newsletter I began back in 2021, the various activities that have grown up around Zero Retries have become a micro business, that Tina and I have laughingly taken to calling "Zero Retries Enterprises". Beyond publishing Zero Retries, there's the M17 book I mentioned a few issues ago, there's another major writing project with a hard deadline of mid-August, perhaps even a third major writing project, and most recently my contributions to making the Zero Retries Digital Conference a rousing success.

There *are* enough hours in the day to get Zero Retries re-platformed... if I were to devote *all* of them to the re-platforming project and the other elements of "Zero Retries Enterprises". Or, I perhaps could have availed myself of concierge services that would have handled the migration of Zero Retries from Substack to Ghost (my preferred new platform) for me. But, the funds necessary for that are now committed to the startup expenses of the Zero Retries Digital Conference.

And... the short, and gorgeous (as in makes life worth living) Summer season is now underway here in our wonderful little corner of the Pacific Northwest. Tina and I want to have some balance of quality of life for the next few months - we both claim to be "retired". 😊 For Tina, besides the intense work of making the Zero Retries Digital Conference an exciting and dynamic event, there is the fun of Summer garden and yard work, and some volunteer work in the community. For me, in addition to the Zero Retries writing work this summer, I have many deferred Amateur Radio projects queued up, including IP400, that I want to enjoy working on in N8GNJ Labs. And I also have a minor commitment for some volunteer work in the community.

Thus Tina and I have decided that devoting the necessary time to "re-platform" Zero Retries... all four plus years of weekly issues... and all the other elements of Zero Retries just isn't realistic to accomplish in the short term. Just one example is that we're very actively promoting Zero Retries Digital Conference with the URL of

<https://www.zeroretires.org/p/conference>

...and we just can't risk that link not working reliably during a transition when we've invested so much time in promoting it.

Nor is a hybrid approach of simply publishing new newsletters on a new platform a realistic option given that I changing the domain name would cause no end of confusion and disruption, etc.

The reasons for moving Zero Retries... all of Zero Retries... off Substack remain valid. *Those reasons are still **heard**, still **understood**, and I still **agree**.*

But moving Zero Retries off Substack is not doable in the short term. Thus moving Zero Retries, *all of Zero Retries* (no half measures) off Substack is being deferred, one last time, until late 2025, when there will be time, and funds available to do it right.

Thank you for your understanding.

##

Better, Cheaper, Smaller, More Cost Effective, and More Efficient Ways To Communicate

I don't own any equipment that uses tube electronics, except one legacy Cathode Ray Tube (CRT) monitor for a vintage PC compatible computer I have that I hope to resurrect for posterity in N8GNJ Labs.

My formal instruction in electronics at (the late) Ohio Institute of Electronics (DeVry) in Columbus, Ohio included tube electronics, but I never saw any in my career... with one exception that I can think of. While working offshore in the Bering Sea, our 100 watt marine HF radio proved ineffective, and we were refitted with a 1.5 kW marine HF radio, and we were given a replacement tube as a spare for that unit. There's a long story (that I'll spare you readers) about why delicate electronics on our company's ships were short lived unless extraordinary care was taken with extensive shock mount isolation. With my training with the comparative efficiency (space, power, complexity) of transistors and integrated circuits, when looking at tubes, I could only see the inefficiencies - space, waste heat, more electrical power required, the dangers, the fragility, etc.

Thus I've seen the transition of tubes, to transistors, to ICs, and now modules as the radios for commercial and Amateur Radio communications. Motorola's mobile radios are testament to this trend - they used to weigh 30 pounds or so to put out 100 watts or so and survive for years in a hot car trunk on dirty 12 volt power. Now the same capability (not at 100 watts) is a few pounds and is built into a small unit barely bigger than your hand.

Radio technologists keep developing better, cheaper, smaller, more cost effective, *and more efficient* ways to communicate. In my writing of Zero Retries, I see such progress very regularly. I'm still in awe of the radio that is at the heart of the early IP400 Network Project units is approximately one inch square, and *that is the radio*. Thus seeing the potential of a Single Frequency Repeater (SFR) that uses Time Division Duplex (TDD) techniques is to me a major win for Amateur Radio by eliminating the need for two frequencies and the need for a complex, big, expensive duplexer. That's a huge efficiency gain. Then add the potential of features like Radio Autoencoder (RADE) Machine Learning (ML) techniques for voice digitization, cryptographic signatures as discussed in in the M17 article below, and integral data capabilities... wow, Amateur Radio repeaters could quickly be in the forefront of radio technology experimentation and development.

That is why I spend so much time and space in Zero Retries prattling on about data repeaters.

This summer, there are two ordinary and unsuspecting repeaters in N8GNJ Labs awaiting some experimentation of fitting them with an MMDVM unit, along with radios I can fit with MMDVM units, and start testing [all the cool modes available in MMDVM](#), *especially [MMDVM-TNC](#)*. I hope to develop some interesting results to report.

##

Weekends Are For Amateur Radio!

I finally figured out a name for this last section of Request To Send!

In trying to make myself accountable for some *personal progress* in **Zero Retries Interesting Amateur Radio**, my "short" list for this weekend includes:

- Unpacking and inspecting my new zBitx HF radio.
- Sorting out my login issues for beta access that I was granted to ARDC's 44Net VPN.
- Minor modification, setup, and updating to the latest firmware of the two IP400 Ichiban units I was given at Hamvention so that I can begin testing and reporting usability and feature suggestions.
- Set up my new Raspberry Pi 5 and Raspberry Pi 500 in N8GNJ Labs to support... well, at the moment, just rabid curiosity about these powerful new variants of Raspberry Pi computers. Eventually the RPi 5 will get a HAT for using Solid State Drive modules. I need to make room on my workbench for a monitor for one of them.
- Inventory and package up approximately *60 pounds* of printed material that I've accumulated over the last six months from several conferences and flea markets and ship it to an Internet Archive scanning center for ingestion into DLARC. (*Thanks Kay!*)

- And... because I won't be able to resist now that I've learned about them, I'll check out the new issues of the AMRAD Newsletter, and the new Packet Radio History collection in DLARC. (*Thanks Kay!*)
- (Last minute addition) - Explore the new Packet Commander app on my iPhone - see the ZR > BEACON item below.

The weather Oracle on my phone predicts direct(!) sunshine and moderate temperatures this weekend, so no excuses to *not* spend the weekend in N8GNJ Labs.

Have a *great* weekend, all of you co-conspirators in Zero Retries Interesting Amateur Radio activities!

Steve N8GNJ

Leave a comment

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What's New at Digital Library of Amateur Radio & Communications — June 2025

By Kay Savetz K6KJN
Internet Archive's Program Manager, Special Collections

One of my favorite things to discover is people whose special interest lies at the intersection of radio and some other — seemingly unrelated — hobby. Until now, my best example of this was the [Bicycle Mobile Hams of America](#), a club for people who love bicycling, ham radio, and doing both together. My new favorite example is Neil Carleton VE3NCE's "[Radio Stamps](#)" radio show, which celebrated the intersection of radio and philately. His specialty was stamps *about* radio.

The program ran for five years (1990 through 1995) on the DX Partyline show of radio station HCJB in Ecuador. The program aimed to combine the fun of listening to international radio and collecting stamps from around the world. The show included stamp collecting tips, contests, descriptions of radio-related stamps, and discussions of radio subjects that could be found on commemorative stamps and postal cancellations.

For me, this particular rabbit hole appeared when the California Historical Radio Society sent DLARC a cassette tape with a [recording of a single episode](#): a scratchy, off-the-air recording of episode 39. I contacted VE3NCE asking about his program. He had a tape of only the [first two](#) episodes. The rest were lost. And that would have been the end of it, except a couple of weeks later I heard from him again: "In preparation for the installation of some new flooring, I've been emptying shelves and moving things to another room. One of my discoveries was a complete set of typed scripts that I prepared for recording my 50 Radio Stamps programs." So thanks to timely home renovation and the scanning prowess of his daughter, we now have [scripts for all 50 episodes of the program](#) (plus the actual recordings of the three episodes I mentioned.)

I learned from [episode 8](#) that the first postage stamp in the world to show a radio receiver was issued by France in December 1938. "This semi-postal issue has a denomination of 90 centimes plus a surtax of 25 centimes. This stamp is special in another way too. The surtax was used to help provide radios for the blind. The design of the stamp shows a blind man listening to a radio." And from [episode 3](#) I learned that in 1964, "a colourful postage stamp was issued in the United States to commemorate the 50th anniversary of the American Radio Relay League. It's a striking stamp, in red lilac, with a denomination of 5 cents."

Radio Stamps is endlessly fascinating, two kinds of nerdy at once, and a wonderful addition to DLARC.

Last month I mentioned the addition of 130+ issues of [AMSAT Satellite Report/Amateur Satellite Report](#): the issues were part of collection donated by Hank Magnuski KA6M. We've added a whole lot more material from KA6M to DLARC, starting with [51 issues of AMRAD Newsletter](#), which is the newsletter of the Amateur Radio Research and Development Corporation (AMRAD). It's unclear to me exactly when that newsletter started, but Hank's collection starts in [May 1980](#) and ends December 1983. We have a few more issues from the 1990s from another source. [AMRAD's web site](#) has an index of articles from 2001 to the present, but those older issues are hard to find. I've added AMRAD Newsletter to the [DLARC Wantlist](#).

The boxes of material from KA6M also included stacks and stacks of papers documenting the early development of packet radio. Magnuski was a mover and shaker in the committees and groups that developed amateur packet radio, and he saved everything! He was involved with the Pacific Packet Radio Society and saved their [early newsletters](#). He wrote a seminal document [On the Care and Feeding of Your Packet Repeater](#). He served on the ARRL Ad Hoc Committee on Amateur Radio Digital Communication, and saved [numerous documents about that group's work](#) from 1982 through at least 1988. There's [so much more](#), including [correspondence](#), [printouts of packet radio BBS discussions](#), [design documents](#) ... an incredible trove of ham packet history, now all digitized, searchable, and downloadable for hobbyists and researchers.

Which leads me to the new [Packet Radio History collection](#) of DLARC, which includes Magnuski's documents plus hundreds more that I've collected from the U.S. government Defense Technical Information Center. There's more on the way — in fact, the best is yet to come — and I hope to tell you about more preserved packet radio history next month.

DLARC has also added 165 issues of the South Bay Amateur Radio Association (based in Fremont, California) [Groundplane newsletter](#); and [more than 800 videos](#) by Patrick Stoddard WD9EWK/VA7EWK. His videos primarily focus on working satellites: a few contain activity by astronauts on the International Space Station. He also contributed about [30 magazine articles](#) that he's written about D-Star, ISS comms, and other digital communication technologies.

The folks at Internet Archive's scanning center continue working through the vanloads of material that I recovered from Fair Radio Sales last summer. We've added [several hundred manuals](#) just in the past month, bringing the collection to over 7,000. Also from the Fair Radio stacks: hundreds of new old [radio catalogs](#). Need a [662-page Cramer electronics parts catalog from 1972](#)? Got it. How about a 1960s (maybe? Hard to tell) catalog of nothing but [replacement television knobs](#)? Got that too. And we've added dozens of books for checkout in the [DLARC Lending Library](#).

Finally, DLARC just added the three-volume set of [The Lenkurt Demodulator](#): selected articles from GTE's "Lenkurt Demodulator" publication, "an informative technical periodical published without charge to technicians, engineers, and managers of companies or government agencies who operate communications systems, and to educational institutions." Covering 1955 through 1975, topics include microwave communications, multiplexing, and digital data transmission.

DLARC Want List: <https://archive.org/details/dlarc-wantlist>

Digital Library of Amateur Radio & Communications is funded by a generous grant from Amateur Radio Digital Communications ([ARDC](#)) to create a free digital library for the radio community, researchers, educators, and students. If you have questions about the project or material to contribute, contact me at kay@archive.org.

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Image courtesy of M17 Foundation

M17 - N8GNJ's Perspective as of June 2025

By Steve Stroh N8GNJ

Some thoughts on the state of the M17 Project, and its progress, in mid 2025.

Bruce Perens K6BP Informal M17 Status Report

[Bruce Perens K6BP on LinkedIn:](#)

I wanted to give a little informal M17 Status report, just in case you've heard some crazy stuff on the net. The project is just fine, and there are an increasing number of commercial transceivers implementing it. This will continue and M17 will continue to be the portable, implementable, Open Source and zero-royalty protocol for Amateur Radio digital voice, and to gain user-share, for some time.

M17 is not, however, the _last_ digital voice protocol, which is why I continue to push fully-programmable transceivers as I have for, uh-oh, must be 15 years now. David Rowe's work on RADE, a machine-learning digital voice autocoder, shows us that the codec-and-modem architecture that we have followed since the advent of digital voice is not the only possible architecture. RADE goes straight from voice to baseband, combining the functions previously carried out by the codec and modem, and somehow doing it better than codecs and modems purpose-written by programmers, including Rowe himself. This will eventually obsolete our leading open Amateur Digital Voice protocols today: M17 and Opulent Voice, both of which were designed for the older paradigm.

An experimental version of RADE is available on HF today due to the work of David, Mooneer, etc., and a derivative may be available soon on fully-programmable VHF/UHF radios like the Comjot, if I can verify that the one I bought really does implement a sufficient-bandwidth path between the computer and the radio. This will remain experimental for some time, and M17 is still the recommended protocol for operations.

Other than I don't consider RADE to be "experimental" now that it has crossed the threshold of a [full release \(v2.0\)](#), I agree with K6BP's assessments of M17.

M17 Foundation is Still New

Absent any substantive news *about M17* from M17 Foundation (other than [M17 Foundation at the Friedrichshafen exhibition](#)) or M17 Project, it can be worrying to have no regular updates from a project that used to have a lot of activity. But consider:

- M17 has just reorganized into the (new) M17 Foundation, with M17 Project (and the M17 trademark) now formally part of M17 Foundation.
- M17 Foundation is currently thinly funded by personal funds of the M17 Foundation board members and a few donations,
- M17 has not received any significant grant funding in 2025. Thus any progress on M17 will be done with "hobby time" and "hobby funding" unless there are (additional) donations and / or commercial implementations of M17, which have yet to be unveiled.

*There's nothing stopping more widespread deployment of M17 other than inertia. As I posited in **Zero Retries 0163** - Why M17 Is Significant - Part 1 and*

Zero Retries 0164 - Why M17 Is Significant - Part 2, all the pieces are in place for more widespread deployments of M17 - [repeaters \(using MMDVM\)](#), now [portable radios with M17 right out of the box](#), Brandmeister network supports M17 ([I think...](#)), etc.

The *M17 is cutting edge, alternative to the mainstream, exciting, edgy, not quite ready for prime time science experiment* phase is largely complete. Not that the *fun* of M17 is over, but the suspense of “*can it be made to work?*” phase is over.

Obviously, the answer is yes, M17 provably works, and is now usable in a variety of forms (and gadgets).

Cryptographic Signatures of M17 Transmissions

Because M17 is *so well-specified, flexible, and extensible*, there’s even more that could be done to make M17 even more capable and usable, especially compared to the now static nature of other Digital Voice systems in use on Amateur Radio VHF / UHF. One compelling example of M17’s extensibility is public key / private key cryptographic signatures of M17 transmissions. Some preliminary work on this has been done by M17’s creator Wojciech Kaczmarek SP5WWP. This was discussed in a series of posts on X (that seem to be publicly viewable) - [@m17_project](#):

https://x.com/m17_project/status/1802298193817776142:

Finally some good news regarding digital signatures. I've been experimenting with ST's CMOX library and just got 160-bit ECDSA to run on the Module17. It takes around 8.25ms to sign a 16-byte M17 voice stream digest. The signature can be appended to the voice stream.
^SP5WWP

https://x.com/m17_project/status/1803457769107751158

Our protocol implementation has just been updated with experimental ECDSA signature support based on the secp256r1 curve. No signature verification has been added yet.

https://github.com/M17-Project/M17_Implementations/tree/auth

^SP5WWP

([ECDSA](#) - Elliptic Curve Digital Signature Algorithm)

https://x.com/m17_project/status/1803791126639370335

Implementing digital signatures in M17 - part 2. Looks like both encoder and decoder work together and the latter is able to verify stream signatures now.

^SP5WWP

GitHub (`auth` and `crypto` branches are the most interesting):

https://github.com/M17-Project/M17_Implementations

Note that this is cryptographic *signing* of M17 transmissions, *not encryption*.

One Fundamental Difference, Two Potential Vulnerabilities

... versus other Amateur Radio Digital Voice systems for VHF / UHF.

Unfortunately, in the bigger picture of Amateur Radio, M17 is not (currently) a significantly better experience or technology for most Amateur Radio Operators versus the significant deployed base of other digital voice system in Amateur Radio, especially Digital Mobile Radio (DMR).

In my opinion, the *most significant differentiation* between M17 and almost every other digital voice systems in use in Amateur Radio VHF / UHF is that M17 is *entirely open source* - *no proprietary elements*. While that is a *primary* qualification for many... it's not a significant *enough* differentiation for most Amateur Radio Operators... who continue to happily use DMR, or D-Star, or System Fusion, or P25, or TETRA.

In my opinion, the first significant liability of M17 is the pending emergence... and eventual dominance of RADE techniques (as explained by K6BP above). M17, as currently specified and implemented, isn't compatible with RADE techniques.

But the dominance of RADE will take a while. RADE (Machine Learning) is compute intensive, but I expect that's only one new version of Raspberry Pi (RPi 6) to transition from possible to *practical* to (soon enough) *routine*.

M17's second significant liability, in my opinion, is that I recently discovered that a DMR repeater can be reconfigured from the usual “two independent time slots” using a receive channel and a transmit channel (Frequency Division Duplexing - FDD) on a DMR repeater to usage as a DMR Single Frequency Repeater (SFR) with one time slot for receive, and the other time slot for transmit (Time Division Duplexing - TDD).

I think that TDD SFRs are a significant innovation in Amateur Radio that will eventually see significant implementation. M17, as currently specified and implemented, isn't compatible with TDD SFR.

But like RADE, I expect TDD SFRs will take a while to emerge. I'll discuss the potential of TDD SFRs in the next article.

M17 in “The Chasm”

In the bigger picture about M17, in my opinion, M17 is currently in the “*chasm*” stage that inevitably seems to develop in new technologies, between “Early Adopters” and “Early Majority” as described in the great book about product (and technology) development [Crossing the Chasm](#).

Wikipedia:

The most difficult step [of “Crossing the Chasm”] is making the transition between visionaries (early adopters) and pragmatists (early

majority). This is the chasm that he refers to. If a successful firm can create a bandwagon effect in which enough momentum builds, then the product becomes a de facto standard, by creating a complete solution for one intractable problem in one business vertical before building out services in adjacent verticals and expanding on from there.

Thus, I think that for M17 to succeed long term and grow “market share” within Amateur Radio, there needs to be a *sustained effort to promote M17 implementations*, especially promotion of M17 capable repeaters and M17 capable devices. To date, as a “project” rather than a “product”, M17 hasn’t been great at either of those types of promotion.

I will stop short of suggesting the creation of a dedicated M17 newsletter (at least authored by me, which would be great, and fun, but more work than I can handle at the moment), but I do commit to continue to promote significant new developments of M17 here in Zero Retries.

M17’s Bright Future in Amateur Radio

Admittedly I’m speculating with this final observation about M17. Perhaps the biggest impact M17 will ultimately have will for it to be the basis for voice and (interchangeably) short messages (data) communications in other systems. None of the other Amateur Radio digital voice systems for VHF / UHF are suitable for transport across a data network (other than what’s already been done via the Internet) because of their use of a proprietary CODEC. M17 doesn’t have such “baggage”, it’s already supported in MMDVM, and its specification is so well done that independently developed interoperable devices have been created. Thus I could foresee that M17 could “easily” be added to an IP400 node such that you could use an M17 portable radio to chat with another local M17 user but instead of using Radio Hotspots that are connected via Internet, you can use Radio Hotspots connected by IP400.

In summary, I think IP400 has a bright future because:

- It was the first digital voice system for Amateur Radio VHF / UHF...
- That has a provably well-developed completely open specification...
- *Developed by Amateur Radio...*
- That’s open source *and...*
- For which a wide ecosystem of independently created interoperable devices has been developed.

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Followup On Single Frequency Repeaters

By Steve Stroh N8GNJ

More thoughts on the efficacy and practicality of Single Frequency Repeaters and why using (Time Division Multiple Access) with one time slot used for receive, and the other time slot for transmit, makes a huge difference in repeater operation.

The topics in this article really didn’t fit into the discussion of M17 in the previous article, but are worth bringing out for discussion. This a continuation of Zero Retries 0205’s article Thorough Explanation of Single Frequency Digital Mobile Radio Repeater.

Perhaps a History of Digital Voice and the Rise of Dual Time Slot DMR Repeaters

I can’t speak from any authority about this, but this is the story I was told in my early Amateur Radio days about the very wide availability of cheap, surplus land mobile radio gear and how the the rise of dual time slot Digital Voice Radios, and repeaters, actually came about. Dual time slots for Digital Voice in a 12.5 kHz channel were a compromise with the US FCC to “kind of accommodate” a roadmap of the FCC to change radio communications from using 25 kHz channels using FM, to 12.5 kHz channels (creating 2x the number of available channels in the same amount of spectrum). Longer term, it was on the FCC’s announced roadmap to eventually require the use of 6.25 kHz channels (creating ~~4x~~ the number of available channels in the original amount of spectrum) *when the available technology* could eventually support that.

The requirement to eventually use 6.25 kHz channels caused the land mobile radio industry (and their customer base) to *panic* about the prospect of *replacing every piece of radio equipment yet again* to meet the 6.25 kHz channel requirement.

So a compromise was proposed. What if the equivalent of 6.25 kHz channels could be implemented by the use of *two independently accessible time slots* in a 12.5 kHz channel. *That’s equivalent to two 6.25 kHz channels, right?* The FCC (and ETSI?) agreed with that compromise, and that’s how we ended up with two independent time slots on every DMR repeater. Note that a typical DMR repeater still requires a transmit channel, and a receive channel.

Time Domain Duplex (TDD) Single Frequency Repeaters (SFRs)

In my opinion, the same “equivalent efficiency” argument applies to a single frequency DMR repeater, with one time slot used for receive, and the other time slot used for transmit. *Single frequencies* are a lot easier to “find room for” in Amateur Radio spectrum, for example, probably enabling a lot more home-based repeaters for experimentation.

To this mere human, it seems that TDD SFRs offer a significant difference in Amateur Radio operations beyond the prevailing digital (and analog) voice paradigms of using Frequency Division Duplexing. Perhaps TDD SFRs are more efficient overall, or perhaps not. I don’t think we’ve ever tried a side by side comparison.

Imagine a blossoming of *hundreds of new repeaters*, perhaps highly localized, enabled by the use of a single frequency rather than a (glacially coordinated, highly contested) pair of “allocated to repeater” frequencies and the lack of a need for an expensive, fussy duplexer.

My enthusiasm for TDD SFRs is not specific to Digital Mobile Radio (DMR). DMR is merely the current most popular potential use of TDD SFRs because current DMR radios seem to be able to make use of DMR TDD SFRs for voice.

But just like inexpensive, embeddable compute power will give rise to easy ML techniques, inexpensive Software Defined Radio (SDR) hardware, driven by the imperative that every computing device is rapidly evolving to at least have the option of radio connectivity, will soon enable TDD SFRs for *any* radio technology, including data, not just DMR. You want Time Domain Duplex Operation in a single frequency? No problem with a Software Defined Radio - *just write that new radio*.

In the Bigger Picture, Why Encourage a Proliferation of Single Frequency Repeaters?

Because the prevailing paradigm of Amateur Radio in the minds, and the limited experience of new Amateur Radio Operators is to buy an inexpensive portable radio, and with typical existing repeaters located on high places (buildings, mountaintops, towers) there just isn't sufficient density to support the extensive use of portable radios, at least indoors, with marginal (rubber duck) antennas, low power, etc. Thus these new Amateur Radio Operators using their portable radios in their homes or apartments have a generally poor experience.

This issue isn't just with use of portable radios. A lot of people, especially new Amateur Radio Operators live in "private communities" or developments that don't permit exterior antennas.

Thus being able to put simpler SFRs in closer proximity for more effective use of users with portable radio and other low power and constrained antennas will materially help Amateur Radio Operators. An example is an Amateur Radio Operator near a big apartment complex could provide a great experience for new, young Amateur Radio Operators with portable radios in that apartment complex.

Portable Radio "Hotspots" using the Internet are also filling this gap, but providing higher density SFRs may well offer "Let's communicate over *radio*" experience rather than "Let's communicate over the Internet".

"Radio Machine Learning"

I think that the techniques of translating human voice or data over Amateur Radio spectrum using Machine Learning (ML) techniques, as [pioneered by FreeDV RADE](#), ML will inevitably be *the* way that communications over radio will be done in the long term. There's just no longer any point in *us mere humans* attempting to design CODECs (Coder Decoder for voice) and MODEMs (Modulator Demodulator for data). *No, that was not humor or hyperbole*. I'm merely doing a straightforward extrapolation that soon enough there will be ample, inexpensive embedded compute capability to make local ML not just possible, but usable, and then desirable, and then "why would you think of doing it any other way?" The same way we now embed very simple and very cheap processors into light bulbs.

Thus ML techniques will be applied to all radio communications (including data) because efficiency is important in radio communications. "Efficiency" should not be confused with minimum bandwidth; channel occupancy is also a measure of efficiency and sometimes a wider bandwidth with shorter channel occupancy is, overall, a more efficient use of spectrum. As for sorting out rapidly evolving new ML techniques for radio interoperability... with a brief instruction from us mere humans, the "Radio MLs" will figure out how to cooperatively create a new "tag" to notify all the other "Radio MLs" that it's using new techniques for a new type of data, such as (just making up an example here) perhaps high resolution stereo audio voice. Or a new format for images, or videos, or a recording from one's ka9q-radio receivers of all four (US) VHF / UHF bands - 50 MHz, 144 MHz, 222 MHz, and 420 MHz.

Thus I think that ML techniques will apply an entirely new layer of efficiency in the future of Amateur Radio communications. Imagine a repeater system that instead of requiring 12.5 kHz of spectrum, requiring only 3 kHz? That is 2x the spectrum currently required by [FreeDV RADE version 2.0.0](#):

It combines Machine Learning (ML) with classical DSP to send high quality speech over HF radio at SNRs as low as -2dB in a bandwidth of 1500 Hz.

And before you fire up the comments to remind me that the use of FreeDV RADE requires a SSB radio and a Windows computer, I have two replies for you:

- Software Defined Radios will do whatever their programming tells them to do (within their hardware limits), such as SSB.
- FreeDV RADE v2.0.0 was demonstrated at Hamvention 2025 running on a Raspberry Pi 5 which costs as little as \$502.

We're in a golden age, fellow Zero Retries fans! We just have to start *using* and *deploying* these incredible technologies to demonstrate how useful Amateur Radio is to society as a proving ground for innovation in radio technology.

Leave a comment

Share

ZR > BEACON

By Steve Stroh N8GNJ

Short mentions of Zero Retries Interesting items.

[Alberta Digital Radio Communications Society Press Release](#)

Calgary, Alberta, June 9th 2025. The society is pleased to announce that it has been approved to receive a grant from Amateur Radio Digital Communications (ARDC) for the development of the high speed IP400 transceiver. Pending completion of due diligence, it expects to begin work in the fall.

"This grant will ensure that we can continue our development activity and bring the project goals to fruition", says Martin Alcock, VE6VH, Chief Technology Officer of the Society and project founder. "It will enable us to recruit top-notch personnel that would have normally been out of our reach".

For more information, please send us a message on our contact page.

This is a publication of the new ADRCS Media Committee, which I was briefly a member. As of 2025-06-09, I do not have any formal affiliation with

ADRCs, especially in regard to promoting the IP400 Network Project.

Despite this, I continue to have ample enthusiasm for the potential of the IP400 Network Project. I continue to posit that IP400 is the Packet Radio Revolution of the 21st Century, and hope to see IP400 mature to the capabilities and potential that I have been promoting.

I do plan to cover the ongoing development of IP400 when there is news to report, in the same manner as I try to cover many other Zero Retries Interesting technologies, projects, and products in Amateur Radio as news of them evolves.

I hope to contribute technically to the IP400 Network Project as a user, testing and experimenting with IP400 hardware, submitting usability suggestions, identifying bugs, etc.

Tina and I hope to see representatives of the IP400 Network Project as a speaker and exhibitor at the Zero Retries Digital Conference on Saturday 2025-09-13.

###

Jeff Geerling, Geerling Engineering, and Level 2 Jeff [YouTube Channels]

Steve Goodgame K5ATA, Ham Media Playlist column in the 2025-06 issue of [QST](#):

Jeff [Geerling KF0MYB] was fascinated by the engineering culture his dad's group of friends fostered. Growing up, he would often pretend to be a radio broadcaster. He started getting into the two-way radio scene with Family Radio Service radios. Jeff later discovered that radio offered a lot of fun through not only receiving, but also via playing with small transmitters and tinkering with software-defined radio (SDR) and Raspberry Pi computers. It didn't take long for Jeff to decide to get his amateur radio license and expand his ability to experiment with RF.

Jeff didn't have a traditional mentor, even though he was friends with many hams. While preparing for his licensing exam, he spoke with Teak Phillips, W0TLP, and some of his dad's radio engineer friends who were also hams, such as Ken Meacham, K0KYZ. As he grew in his experience, he ended up having great conversations with Kyle Krieg, AA0Z, as well. To Jeff, part of the allure of the amateur radio community is the wide range of niche interests that exist. Many of his friends have interests in POTA, emergency communications, packet radio, nets, and SDR. Each individual makes meaningful contributions to the group and, thus, keeps Jeff plugged in.

In Zero Retries, I *rarely* cite items that are behind a paywall. This article is only accessible to ARRL members. I'm mentioning it here in Zero Retries because it was a refreshing change from the usual QST profile of individual Amateur Radio Operators that KF0MYB isn't a contester, doesn't (currently) do HF or DX, doesn't do CW (Morse Code), etc. KF0MYB is a gifted communicator first, and enjoys experimenting with computers (especially Raspberry Pi) and his Amateur Radio activity is just one activity of many that he enjoys explaining.

I was glad to read that KF0MYB has a support group to help him in his Amateur Radio activities in the St. Louis, Missouri area.

I've been a fan, and a follower of KF0MYB's excellent YouTube videos. He is often one of the first to announce (and is provided early access) to new developments with Raspberry Pi computers. He is a detailed and impartial reviewer, and more importantly, a very active (and demanding) and capable user of Raspberry Pi computers.

I've mentioned KF0MYB and his activities and videos a number of times in Zero Retries because he is an excellent example of NewTechHams that are becoming Amateur Radio Operators in this era, with vastly different expectations of, and contributions to Amateur Radio than legacy Amateur Radio paradigms.

KF0MYB's YouTube channels:

- **Jeff Geerling** - <https://www.youtube.com/@JeffGeerling>
- **Geerling Engineering** - <https://www.youtube.com/@GeerlingEngineering>
- **Level 2 Jeff** - <https://www.youtube.com/@Level2Jeff>

###

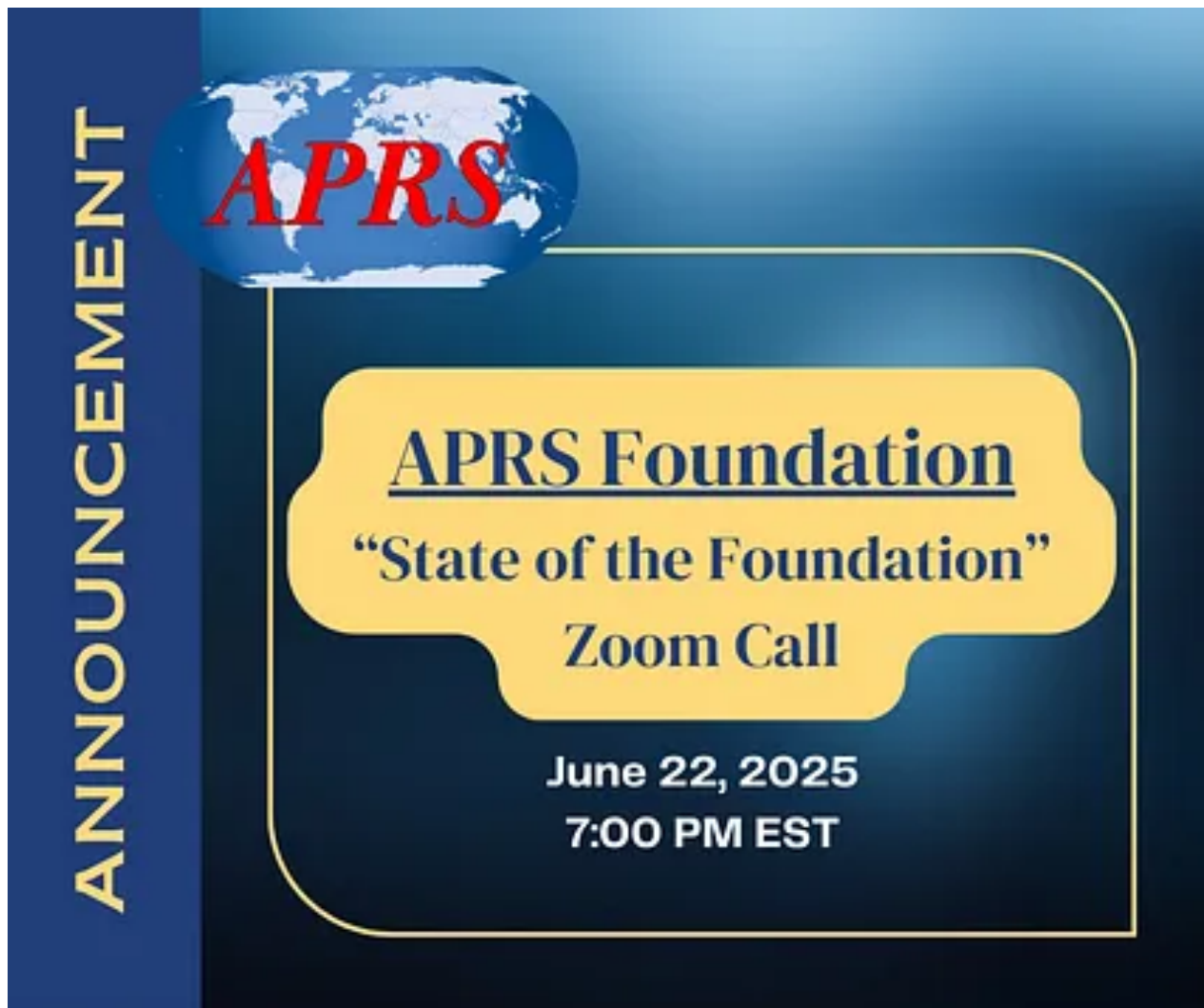


Image courtesy of APRS Foundation

APRS Foundation "State of the Foundation" Zoom Call on June 22nd @ 1900 (7PM) EST

Jason Rausch K4APR on the aprssig email list:

The APRS Foundation will be holding a public Zoom call on June 22nd at 1900 (7PM) EST to present the "State of the Foundation" update. We'll be discussing recent changes in the officer lineup, newly added board directors and paying tribute to Lynn Deffenbaugh, who we lost in the past year and calling for volunteers for several tasks. This call will be limited to one hour and will include a question and answer session after the slides. We'll do our best to make the presentation short and to the point, so we can address as many questions as possible. Please join us at the below Zoom link (link will only be active for the meeting time):

[Corrected link]

<https://us06web.zoom.us/j/81634671105?pwd=QEqaSTvJfbRISEaTxflwdjl60e3tb0.1>

As always, we do our best to keep the foundation's website up to date:

<https://www.aprsfoundation.org/>

Thank you!

Jason Rausch K4APR (APRSF Director)

There was a seminar at Hamvention 2025 by APRS Foundation (at least one was scheduled):

APRS - State of the Union

Begin: 3:10 PM

End: 4:00 PM

Location: Room 3

Moderator: Jason Rausch, K4APR

Speaker: John Tarbox, WA1KLI

Description:

APRS (Automatic Packet Reporting System) plays a crucial role in real-time tactical digital communications for amateur radio operators worldwide.

We will explore the current state of APRS, including its infrastructure, applications, and ongoing projects.

We will also discuss the future of APRS. Whether you're a seasoned APRS user or just getting started, this session will provide valuable insights into where APRS is headed and how you can contribute to its evolution.

I had hoped to attend that one, but I got drawn into a very interesting conversation and missed it, thus I don't know if it happened, or didn't, or what was said there.

*Zero Retries readers - did you attend the **APRS - State of the Union** Forum at Hamvention 2025? If so, could you drop me an email - steve@zeroretries.net?*

That seminar was (apparently?) not recorded (that I'm aware of - it's not currently on the [DARA Hamvention YouTube channel](#)), and APRS Foundation hasn't posted *anything* about Hamvention on their website, their email list, or the aprssig email list. That kind of silence after a major conference, and the lack of attention to maintaining their website (for example, posting this announcement there) is... concerning.

Thus I'm glad to see this announcement. After seeing nothing resulting from Hamvention, with a decent interval for folks to catch up, I had pinged APRS Foundation on their email list on 2025-06-08:

Any updates from APRSF?

Last update was dated 2025-02-07:

<https://www.aprsfoundation.org/hamcation-2025/>

Other than deleting Jeff W4JEW (<https://www.aprsfoundation.org/leadership/>)... nothing has changed on the website that I can see.

And of course, the stated APRS Summit 2025 scheduled for 2025-05-10 (<https://www.aprsfoundation.org/events/>) didn't happen:

What say, APRSF Board of Directors?

John T?

John L?

Jason?

Speaking as a paid member, it seems like there should be an update TO THE MEMBERS of the state of the APRS Foundation. *I think that's the least we're owed* after being patient for months with no communication whatsoever from the APRSF.

I didn't get an answer to my message on the email list, but this is certainly good enough. I look forward to hearing the updates from APRS Foundation.

#

[Packet Commander - The Terminal App for AX.25 Packet Radio on iOS](#)

Email from Georges Auberger WH6AZ - Island Magic Co. at 07:30 Pacific *today*:

Aloha Steven,

I'm excited to share that Packet Commander is now available on the App Store!

I built this app in hopes of bringing a smooth, modern packet radio terminal experience to iPhone and iPad.

And the best part? It's free to try. You get 5 full connection sessions to explore the features and confirm compatibility with your setup before committing to a purchase.

So what are you waiting for? Command the airwaves!

I had planned to run this article as "discovered this interesting development for Amateur Radio Packet Radio hiding in plain sight on the Island Magic Co. website", but Packet Commander is *now available*!

And... *confirmed*! I just downloaded it from the IOS App Store onto my phone. Great... *another* thing to add to the list for the (now busy, but interesting) weekend.

Features

Powerful Terminal

- Full-screen terminal for interacting with packet nodes and BBS over amateur radio
- Classic color themes inspired by iconic computers
- Adjustable fonts and layout for readability and screen efficiency
- YAPP protocol support for file transfers

- Dictation-ready for composing messages hands-free
- Smart filename selection — double tap to highlight and copy

Smarter Packet Connections

- Location-aware digipeater routing: automatically recalls the last-used path at each location
- Seamless iCloud sync for nodes and digipeaters across all your devices
- Compatible with popular packet node software including BPQ32, URONode, and others

Works with the Gear You Love

- Auto-discovery of Bluetooth and TCP TNCs, including Dire Wolf on DigiPi
- Automatic frequency set/restore on supported radios
- Built-in, high-performance 1200 baud AFSK software modem
- Optimized for VHF/UHF packet at both 1200 and 9600 baud

See the web page for additional details.

This is a really cool development (~~not yet available~~), from Georges Auberger WH6AZ, the developer of the [RadioMail](#) app for IOS and the [B.B. Link Adapter](#) for use with the Kenwood TH-D74A and TH-D75A portable radios.

My thanks to Zero Retries reader Bill Arcand W1WRA for pointing out that news of Packet Commander is now public.

###

Mention of Raspberry Pi Compute Module 4 (CM4) in FlexRadio Units Wasn't Meant to Imply "Hackable"

Comment for Zero Retries 0205 by Eric Grumling:

Readers should keep in mind that just because it is using a CM4 doesn't mean it is running Raspbian. It is most likely running VxWorks or Yocto Linux. These are real time operating systems (RTOS) that are optimized for performance and stability. While I'm certain in the longer timeline someone will swap out the installed CM4 with one that has a more hacker friendly OS installed, embedded Linux isn't for the casual user. There's not going to be a package manager, for example. Things will be locked down.

But it is a huge step in the right direction. Kudos to Flex Radio for letting us know what's under the hood!

(The name "Raspbian" for the official Raspberry Pi version of Linux has been deprecated. It's now called Raspberry Pi OS.)

There was also an email from Bill Diaz KC9XG:

Detailed info on differences and possible incompatibilities between the CM4 and the CM5 [Compute Module 5]:

<https://www.raspberrypi.com/news/meet-the-engineer-dominic-plunkett-on-compute-module-5/>

Point taken to both Eric and KC9XG. In my article in **Zero Retries 0205** - Minor Scoop About FlexRadio's Impressive Engineering, I didn't mean to convey that the FlexRadio units using the CM4 should be considered "hackable" by users, or that FlexRadio doing an upgrade from the CM4 to the CM5 in their radios would be "easy".

What I *was trying to convey* was my admiration for FlexRadio's use of the CM4 as (what I consider to be) elegant and cost-effective engineering. Using a Raspberry Pi Compute Module (the CM4 was probably the only choice at the time the 8000 series was designed, much of which was inherited by the Aurora series) was a sound engineering decision. Given Raspberry Pi's longstanding assurance of long term availability to industrial customers like FlexRadio, using a Compute Module 4 provided not just a reliable supply, but a reasonable expansion path to *potentially* upgrade those FlexRadio units to a Raspberry Pi CM5 *if* that is eventually warranted.

###

SteppIR to Discontinue Amateur Radio Sales

Pop up notice on SteppIR's website when Amateur Radio is selected:

To all our valued customers:

STEPPIR

Due to several emerging factors, SteppIR will cease production of consumer antennas and accessories on August 31, 2025. We will accept and fulfill all consumer antenna and spare parts orders placed by August 31. After August 31, we will sell spare parts as long as supplies last.

There will be no changes in terms of warranty service or technical support inquiries.

Given our long history of impact and innovation, we don't take this decision lightly but have decided it is necessary for our ongoing operations, and to make sure we can continue to efficiently provide our existing customers with product support services.

73 from all of us at SteppIR



SteppIR is based in the Seattle, Washington USA area and thus they're one of the few remaining radio related manufacturers in the region. The only other big company in Amateur Radio in our region is [one of the offices of Icom America](#). In fairness to SteppIR's innovations in Amateur Radio, I should have highlighted them and their innovations... and often.

SteppIR's technology is (was, I guess now) another example of *technological innovation in Amateur Radio* that I constantly talk about in Zero Retries. Unfortunately I never got around to mentioning SteppIR's significant innovation in the unsung area of active HF antennas. In SteppIR's case, instead of dissipating (wasting) transmit power in an antenna tuner unit between a (matched for 50 ohms) transmitter and a mismatched antenna... SteppIR antennas were capable of being tuned so that there was no mismatch, on any frequency within their tuning range. All the power of the transmitter can then be coupled into the antenna.

But SteppIR antennas are expensive (justifiably, in my opinion, given their technology). Over time, SteppIR found a much more receptive and lucrative market in the re-emergence of HF communications in commercial use, especially some HF applications where the price of SteppIR antennas was of little or no concern.

I don't blame SteppIR for forgoing the Amateur Radio market. I think this revered advice³ applies:

Don't Cry Because It's Over; Smile Because It Happened.

##

[HAM RADIO Job Market Shows Career Opportunities](#)

In 2025, the HAM RADIO job market will once again offer the ideal platform for training, jobs and careers - for all sectors!

You can easily post your offer online on our homepage. The advertisement will also be presented on the job market pinboard in Foyer WEST

during the trade fair. This allows you to reach your target group directly, personally and without wastage.

■ Our offer: € 150.00 (for up to 3 ads)

Take advantage of this opportunity - whether you are an exhibitor at HAM RADIO or not!

Kudos to the marketing team of HAM RADIO! This was just one item from the most recent informative email(s) that I've been getting for the last month or so leading up to the big [HAM RADIO conference in Friedrichshafen, Germany on 2025-06-27 thru 29](#), just a few weeks from now.

This is in contrast to communications from Hamvention (Dayton Amateur Radio Association). Hamvention doesn't offer individual, direct outreach for Hamvention (that I can find), only links to Twitter (they still use the bird symbol), Facebook, and YouTube.

Offering HAM RADIO Job Market really helps to tie together the commercial uses of radio technology with Amateur Radio and reinforces that...

Ultimately, amateur radio must prove that it is useful for society.
Dr. Karl Meinzer DJ4ZC.

#

Zero Retries Guide to Zero Retries Interesting Events Updated

This week I updated the Events page to add a few conferences that I recently learned about. As part of that update, I tried to add all of the ARRL Division conventions that I could find... and I noted an interesting dichotomy.

I didn't dive too deep into this, but it struck me that some ARRL Division conventions were *significant multi-day events*, such as [SEA-PAC](#) (Northwestern Division) and [Pacificon](#) (Pacific Division) that offer a number of forums. They are well-produced, held at nice venues, have informative websites (and unique names, such as SEA-PAC, Pacificon, etc.) that were easy to discover.

Then there are a number of ARRL Division conventions that seem to be held in conjunction with one day Amateur Radio / electronics flea markets (with few or no seminars, other than an ARRL forum).

In the Zero Retries perspective, the significant multi-day events are well-marketed and thus inviting and interesting to potential new Amateur Radio Operators. The variety of forums, and commercial vendors at such events make it a lot easier to "Discover Amateur Radio".

#

New Starlink Performance Kit

Disclaimer - I'm not receiving any revenue from mentions of Starlink in this article.

Marketing email from Starlink:

Starlink Performance offers high-speed connectivity and durability in the most remote and extreme environments, ideal for travel, boating, and all mobile applications.

New features on the Performance Kit include both AC and DC power inputs, an aluminum enclosure and ruggedized connectors for endurance in extreme weather, and an enhanced waterproof rating for the highest level of protection against water, dust, and debris. [See Durability Guide here.](#)

The Starlink Performance Kit is capable of download speeds up to 400+ Mbps for high-speed connectivity whenever you need it. Additionally, the Performance Kit will support increased speeds as we make future network enhancements. No hardware changes needed.

Available now for \$1,999 on Roam.

What's in the Box

The Starlink Performance Kit arrives with your Starlink, Advanced Power Supply, 25m Starlink Performance Cable, AC Power Cable, DC Power Cable, and 5m Ethernet Cable.

A choice of mount and optional free router is also included with the purchase of a Performance Kit but not included in box.

I've seen a number of third party kits that attempt to "ruggedize" the consumer version of Starlink units, but this one seems to answer the issue of "can it handle *my* challenging situation?" The words of my friend Steven Roberts N4RVE ring in my ears from his era of designing the [Microship](#) - "Water corrupts, but *saltwater* corrupts *absolutely*." And now Starlink has answered the "marine usage issue" with the Performance Kit. If N4RVE was doing the Microship in this era, it would undoubtedly have a Starlink Performance Kit. Imagine livestreaming a trip in a small boat down a river like the Mississippi. [River Horse](#), sponsored by streaming video!

Starlink just continues to impress me. Compared to the daily dropouts I experienced with Comcast, and the endless hassles and annoyances with "let's slip another random charge onto your monthly bill", Starlink just works, the pricing is consistent, and it's remarkably no hassle. I haven't had a service interruption in months.

And Starlink is paying attention to even the small pain points. They just released the [Router Mini](#), priced at only \$40. Its primary purpose is to act as a wired or wireless Wi-Fi extender. I have one spot in my house furthest away from the house router in the garage, and so I'll try putting this unit inside the house and see if it improves the coverage. At \$40 it's a worthwhile experiment.

A fun mention of Starlink... after I got my Starlink working in our household with the primary router in N8GNJ Labs, and a long Ethernet cable in a conduit between the N8GNJ Labs and the house, and a second Starlink router inside the house, Internet in our household Internet has been "*it just works*" reliable and hassle-free. At an appointment this week, my wife Tina KD7WSF was listening to a receptionist complain that she was having trouble checking Tina out because the office's Internet was acting up again. Tina gave her my phone number and told her "My husband can could fix your Internet

problem - just give him a call". When I picked her up she said "I pimped you out for tech support. They're having problems with their Internet again, and told them you could help them. All you have to do is tell them about how reliable Starlink is, and how easy it is to install." *True, that.*

As long as I'm gushing about Starlink, two last interesting data points ...

- If I were to get into the "Fix your Internet" business, Starlink now has an [Authorized Reseller](#) program. Never say never... Not to mention that Starlink now have a *wide* variety of mounting adapters, and there's a big third party market for adapters, enclosures, extenders, vehicle mounts, etc.
- I saw this mention as I was scrolling down the Starlink page:
GIGABIT SPEEDS AVAILABLE IN 2026

Starlink is focused on making network enhancements which will enable gigabit speeds starting in the most remote places on Earth with the Performance Kit. Service plan upgrades will be available in 2026. No hardware changes needed.

The Starlink Performance Kit is currently capable of download speeds up to 400+ Mbps for fast, reliable connectivity whenever you need it.

There was an old phrase in the computer industry of the 1960s:

IBM isn't the *competition*, it's the **environment**. The implication was that IBM was so dominant, so ubiquitous, its sales, services, and range of equipment was so comprehensive that it was very hard to compete directly with IBM.

Starlink is quickly becoming **the environment** of telecommunications *worldwide*. It's the *only* truly worldwide Internet / Telecommunications Service Provider. It's about to begin providing mobile telephone service. Fiber providers were probably laughing about "Starlink as a competitor" right up to the point where Starlink starts offering Gigabit speeds. Mobile carriers were probably laughing about "Starlink as a competitor" right up to the point where Starlink Mini debuted and people, and truckers, and boaters, and even private pilots starting attaching them to their vehicles for high bandwidth continuous Internet access.

[Starlink Mini](#) that fits in a backpack, that can be powered by a USB-C battery pack... *still* blows me away. See my story about [my "Meadow Day" experiment](#).

#

Reasonably Priced Uninterruptible Power Supply, including USB and 12 Volts Outputs

Disclaimer - I'm not receiving any revenue from this article or this unit.

This has never happened to me before. I watched this video (it's a glowing, but realistic review - I recommend subscribing to the channel) and then ran out to our local Costco. After thinking about on brief trip, I bought... a few... of these EcoFlow River 3 Plus Wireless Boost Combo units. Our (Bellingham, Washington) Costco had a pallet of them in their electronics area. It's impressive that our Costco had them, given that it's literally at the end of the Costco US logistics chain given that Bellingham is twenty miles South of the Canada border.

As the video explains, this isn't just a typical portable power station... it has the same functionality as an Uninterruptible Power Supply, complete with a USB output to signal to a computer when power has been lost, and when the battery is almost exhausted. This was motivating to me as I just had two typical UPS units, both with sealed lead acid (gel cells) die on me recently. Yes, the failure was merely the battery going bad, and yes, I could replace the battery. But the last time I tried to replace the battery in my higher end APC UPS... the battery was priced at something like 80% of a completely new unit. And the battery had died after only three years or so.

In contrast, the EcoFlow River 3 Plus can work as a UPS for 120V AC devices. It also includes a single USB-C and two USB-A outlets, and a 12 volt "cigarette lighter plug" output, which are handy options for a UPS. As with all portable power systems of this era, it has an input for solar panels, with that input doubling as a 12 volt DC input for charging if that's all you've got (such as using it on a trip in a car, and that adapter cable is included in the package).

The "Wireless" refers to this unit (at least, as sold at Costco) being sold with two small standalone battery units that support Qi2 "wireless" (induction charging), with one (integrated, tuck-away) USB-C plug, and a USB-C jack. They can be charged "wireless" in a dedicated recess at the top of the unit. (As an example of the value proposition of this particular "bundle", I just bought a similar small standalone battery unit prior to Hamvention 2025 in case

my phone needed a topping off from doing a lot of recording, and that one unit (a bit higher power than these) was at least \$60.

Best of all, this “UPS” uses a LiFePO4 (Lithium Iron Phosphate) battery, and some of my Li-ion batteries are now well past five years old and still working well. Now that I have a reasonable option for a LiFePO4 UPS, I’ve bought my last lead acid battery - good riddance! (Same feeling of relief in having bought my last CRT, my last floppy drive, my last incandescent and fluorescent bulbs, etc.)

The EcoFlow River 3 Plus not quite beefy enough to serve as *the* power system for my radio desk, either in output or capacity, but I discovered something interesting. The battery capacity of these units can be easily *doubled* by connecting a secondary battery - [see the relevant Ecoflow page](#). There’s a recessed integral connector on the bottom of the unit - no bulky or inconvenient interconnecting cables.

One of these units is going into N8GNJ Labs as the new “UPS” for the Starlink router that supplied power to the Starlink antenna, and a few other critical loads. And another one of these will be going with us on any extended car trips to power any 12 small 12 volt loads continuously without endangering the vehicle battery.

Sometimes modern technology really amazes me, like the combination of this unit, the extended battery pack, a small and inexpensive solar panel, keeping my Starlink system powered up indefinitely during an extended power outage. Netflix streaming, email, video conferencing, (voice over Wi-Fi option turned on) phone calls, and of course providing Amateur Radio over Internet services.

#

[Sorcerer - Building a Nervous System for the Atmosphere](#)

Y Combinator:

Sorcerer is deploying a global network of persistent airborne sensors to fuel advanced weather forecasting. Our high-altitude balloons collect 1000x more data than existing systems and are already used daily by meteorologists to track extreme weather across the US and Central America.

The problem & background

Hundreds of terabytes of weather data are collected from satellites, ground stations, airplanes, and weather balloons every day. In-situ weather observation has the most impact on weather models, but it’s incredibly expensive to collect. The US National Weather Service spends over a billion dollars annually just on its network of weather balloons, stations, and aircraft sensors. Despite this cost, there are still places in the US where we don’t know what the temperature will be two days from now. And for the 80% of the world that lacks any weather infrastructure? There’s always the weather rock.

The solution

We’re launching a global network of persistent weather balloons to provide real-time data in previously unreachable locations. Each balloon remains airborne for over six months, completing ~30 laps around the globe while navigating between sea level and 65,000 feet. We’re able to collect 1000x more data per dollar than current systems, and we use this unique data to train AI weather models that are up to 50% more accurate than today’s best forecasts.

Cool program, and I wasn’t aware that there were such gaps in weather observation.

I emailed CEO Austin Tindler suggesting that Sorcerer could deploy an inexpensive and ubiquitous network of ground stations by partnering with Amateur Radio Operators worldwide, and that Amateur Radio already uses APRS to receive telemetry from amateur high altitude balloons. I also noted that [SatNOGS](#) has a network of ground stations to receive telemetry from research satellites in Low Earth Orbit.

#

[Development, the American Way](#)

Jude Russo in the July / August 2025 issue of The American Conservative:

*Disclaimer - Don’t reflexively go nuts that I’m mentioning this publication in Zero Retries. One friend I emailed this to fired back within minutes - “Why are you sending **this** to me?!?!?”*

I promise that there’s a Zero Retries Interesting angle in this story. Read or skip through the initial paragraphs of history about the FCC, that its primary mission was regulating AT&T (a vast simplification, in my opinion), and the rumination about industrial policy relating to 5G. Then the Zero Retries Interesting stuff starts.

On a crowded, 100-year-old common like the radio spectrum, concerns can arise from unexpected places. The FCC periodically reviews its regulations; the latest round was announced in March by a public notice with the provocative title “In Re: Delete, Delete, Delete.”

...

The announcement, combined with the [renewed interest](#) in restoring the commission’s power to auction off spectrum space, was greeted by a flurry of angst in a group you might not expect: amateur radio operators, or hams.

Title 97 of the *U.S. Code of Federal Regulations* defines amateur radio thus: “A radiocommunication service for the purpose of self-training, intercommunication, and technical investigations carried out by licensed individuals interested in radio technique solely with a personal aim and without pecuniary interest.” In layman’s terms, the amateur service is a sandbox for private individuals’ experimentation with and technical development of radio-spectrum technologies, from homebrew networking to building international communications relays.

Bruce Perens, a founder of the Open Source movement and an avid amateur radio operator, emphasizes that this is the fundamental value proposition for the amateur service. “Amateur radio is the only system where you can change the network of a wide area, network something that is a city or even international,” said Perens. “You could not do that on the phone system, for example. So this is where a lot of people learn the wireless technology and electronics.” The list of famous hams vindicates the point; it includes the Nobel-winning physicist Joseph

Taylor, the inventor of the walkie-talkie Al Gross, and the Apple cofounder Steve Wozniak. (As mentioned above, Dale Hatfield's long career also began on the amateur bands.)

During a period in which American industrial ambitions are [heavily checked](#) by the absence of a trained technical pool, such a space is invaluable. "That's why Silicon Valley, for example, was started by radio hams, and that [still] goes on," Perens noted. "If you look in the high-tech companies, they're just a lot of people with these letters and numbers [i.e. amateur radio callsigns] after their name. And so we have to understand that this has a tremendous value as far as STEM education."

For all this article's overall flaws, overstatements, and omissions about telecommunications in the 21st century (and the past...), I think this article is notable that it's one of the first in a non-technical, non Amateur Radio publication that allow the case to be made *that Amateur Radio is a valuable, useful resource in the 21st century* because it's a source of self-education and experimentation about radio technology. Note that Dale Hatfield is formerly WO1FO (and used to be significantly involved in Amateur Radio - see this [notable speech](#)). Bruce Perens K6BP is extensively quoted in this article and makes many relevant points about US Amateur Radio and the ways it could be improved.

I recommend reading the entire article.

##

Single Pair Ethernet (SPE)

I was unaware of Single Pair Ethernet until I read an article about a [new Arduino UNO SPE Shield](#). The article explains:

Single Pair Ethernet relies on just two wires to carry data and power, allowing for much more compact designs and simpler wiring compared to traditional RJ45-based solutions with Cat 5 cables. It especially benefits IoT and IIoT applications for buildings, factories, and process automation.

Wow, that sounds like a really great solution for a lot of cases where it's advantageous to have simpler, cheaper wiring. I was imagining the growing use of remote radios on poles and other high places like a future variant of IP400 and the Icom IC-905. For example, being able to use a single pair cable with larger diameter wires for transmitting more power.

[Control.com adds a bit more detail](#):

The SPE topology can also support Power over Data Line (PoDL), which is used to supply power for enabled devices and communication all over the same two wires.

...

The biggest disadvantage to SPE is the max distance cables can travel before a repeater is required. With four-pair Ethernet transmission, speeds of 1 gigabit per second (Gbps) are maintainable up to a distance of 100 m. With SPE, that same speed maxes out at 40 m.

Unlike conventional Ethernet's use of an RJ45 connector, because the primary use for SPE is industrial and automotive, there doesn't seem to be a standardized connector.

Wikipedia's **Ethernet over twisted pair** article has a brief mention of [single pair](#). The detail there dampens my interest for SPE as SPE wiring still has to be "structured" with a consistent twisted pair with "an impedance of 100 Ω ". I was hoping that SPE wiring could be "less structured". Thus for Amateur Radio use, it sounds like it's more practical to use the much more widely used, and consumer priced "normal" Ethernet.

And it's one of those fun coincidences that in the same week that I learn about Single Pair Ethernet (kind of "Ethernet, Junior") I read a mention of the [Ultra Ethernet Specification v1.0](#) (PDF):

The Ultra Ethernet Consortium (UEC) is an industry effort — involving many contributors including hyperscalers, system vendors, silicon providers, and others — with a mission to enhance Ethernet for use in AI [Artificial Intelligence] and HPC [High Performance Computing].

##

[VP-Digi - APRS Digipeater Controller with Built-in KISS Modem](#)

VP-Digi is a functional, affordable, easy-to-assemble, and configure STM32-based APRS digipeater controller with a built-in KISS modem.

- Multiple modems:
 - 1200 Bd AFSK Bell 202 (VHF standard)
 - 300 Bd AFSK Bell 103 (HF standard)
 - 9600 Bd GFSK G3RUH (UHF standard)
 - 1200 Bd AFSK V.23
 - PWM (or deprecated R2R) signal generation
- Analog-digital busy channel detection (data carrier detection)
- AX.25 coder/decoder
- FX.25 (AX.25 with error correction) coder/decoder, fully compatible with Direwolf and UZ7HO Soundmodem
- Digipeater: 4 settable n-N aliases, 4 simple aliases, viscous delay (known from aprx) or direct only, black and white list

- 8 independent beacons
- KISS mode (can be used as an ordinary Packet Radio, Winlink, APRS, etc. modem)
- USB and 2 UARTs: independent, running in KISS, monitor, or configuration mode

I learned about this device from an [eBay listing](#) for an assembled unit. Apparently this project was [first developed in 2020 by Piotr Wilkoń SQ8L](#), and I was unaware of it until now.

SQ8L's [extended article about the VP-Digi](#) mentions this key feature of VP-Digi:

Additionally, a **digital carrier detection (DCD)** is implemented. It uses an approach of looking for correct modulated signal rather than checking demodulated data. This algorithm provides much better results, is more sensitive, but at the same time is more immune to noise. That's how VP-Digi works very well with devices with open squelch.

In my early usage of 1200 bps AFSK AX.25 Packet Radio, the need to set the squelch meant there were a lot of missed packets when the squelch didn't open fast enough to catch the early part of a packet transmission. TAPR came out with a ["True" DCD Mod](#), which made all the difference in the world because you could then dial the squelch all the way down and still receive packets. Thus the VP-Digi incorporating a real DCD capability is a great feature.

The relative simplicity of the VP-Digi seems like a better option for an unattended, remote Packet Radio digipeater than a combination of a Raspberry Pi, an audio interface, and Dire Wolf software TNC. And certainly more cost effective than the much more expensive Kantronics KPC-3+ and 9612XE units when used for digipeaters.

Kudos that the VP-Digi supports higher speed packet radio modes and FX.25. It would be cool if it could be extended to support the newer Improved Layer 2 Protocol (IL2P) Forward Error Correction (FEC) as well as FX.25 FEC.

While I prefer to promote the use of full duplex repeaters for wide area data communications networks, digipeaters continue to have their uses.

##

Skyroof: New Ham Satellite Tracking And SDR Receiver Software

RTL-SDR Blog:

Recently VE3NEA has [released a new Windows program called "SkyRoof"](#). SkyRoof is both a satellite tracking and SDR receiver program. It supports the RTL-SDR as well as Airtys and SDRplay devices.

The software is designed for tracking and receiving ham radio satellites, and it can provide detailed information about all ham satellites, tracking them in real time, and provide pass prediction. It also shows a skymap and SDR waterfall display. The receiver software supports demodulation of SSB/CW/FM, and it automatically compensates for doppler. It can also interface with antenna rotators that support hamlib.

The combination of satellite tracking and Software Defined Receiver makes a lot of sense to me. Cool that it supports those three inexpensive and capable Software Defined Receivers.

##

Radio Apocalypse: Meteor Burst Communications

Dan Maloney N7DPM on Hackaday:

Every day, the Earth sweeps up a huge number of meteoroids; estimates range from a million to ten billion. Most of those are very small, on the order of a few nanograms, with a few good-sized chunks in the tens of kilograms range mixed in. But the ones that end up being most interesting for communications purposes are the particles in the milligram range, in part because there are about 100 million such collisions on average every day, but also because they tend to vaporize in the E-level of the ionosphere, between 80 and 120 km above the surface. The air at that altitude is dense enough to turn the incoming cosmic debris into a long, skinny trail of ions, but thin enough that the free electrons take a while to recombine into neutral atoms. It's a short time — anywhere between 500 milliseconds to a few seconds — but it's long enough to be useful.

This is a great overview of Meteor Burst (sometimes known as Meteor Scatter) Communications. This technology is even more usable in this era with inexpensive Software Defined Receivers able to listen to many bands and frequencies simultaneously to "sense" available Meteor Burst paths and respond fast to such availabilities, using techniques such as Forward Error Correction and perhaps Multiple Input Multiple Output (MIMO) to take advantage of multipath signals.

But now we have cheap, high bandwidth Broadband Internet thanks to Starlink. But it's still fun to experiment with such techniques.

One of the many radio technology companies nearly lost to history here in the Pacific Northwest is **Meteorcomm** in Renton, Washington. Although they are no longer in the "Meteor Communications" business, they [explain their development of that technology](#):

Founded in 1975 and headquartered in the state of Washington ever since, Meteorcomm® has been a pioneer in wireless communications technology for multiple industries around the world. We started as a small consulting company that commercialized meteor burst communications as an effective and reliable alternative to satellite communications.

The technology was elegant. Relying on ionized meteor trails in the earth's atmosphere, the communication system harnessed these trails to reflect radio frequency between two locations. We found that meteor burst communications was well suited for long-range, low data rate messaging across vehicles, locomotives, marine vessels, aircrafts, and even remote hydro-meteorological stations. That's why Meteorcomm® technology was quickly adopted by a global customer base spanning every continent and multiple industries.

In the 1990s, we developed and patented Extended Line of Sight (ELOS) as a method to communicate real-time data up to 50 miles. We were

able to achieve this extended range of communication by taking advantage of diffraction around the curvature of the earth, atmospheric diffraction, and tropospheric propagation.

###

[RTL-SDR Blog V3/V4 USB-C Model Released For Sale](#)

RTL-SDR Blog:

We're happy to announce that we have released a new USB-C version of the popular RTL-SDR Blog V3 and V4 dongles on our store at www.rtl-sdr.com/store!

Many members of the RTL-SDR community have been requesting a USB-C version for some time now. The dongle circuitry is identical to your favorite V3 and V4 models, but the USB-A plug has been replaced with a USB-C female plug instead.



The new V4c RTL-SDR Blog V4 with USB-C Plug

Please note that you will need a USB-C cable to use the dongle (not included); however, we always recommend using a USB cable with the dongle anyway to avoid strain on your USB ports and to get the dongle further away from the RF-noisy PC. Also, please note that the dongle is still USB 2.0, as simply changing to a USB-C plug does not change the USB spec.

So far, we have only produced a small batch of these USB-C dongles as a trial to test the market. If they prove popular, we will increase the number of dongles manufactured.

For now, we are only shipping these new units worldwide from our warehouse in China. They can be purchased at www.rtl-sdr.com/store. Amazon USA will be stocked with a few hundred of these dongles within about a month.

This just makes so much sense and as soon as they are in stock via Amazon in the US, I'll order a few for some pending projects I have.

Now if only we could get a Raspberry Pi to have USB-C ports.

###

[Detect Radio Jammers with Raspberry Pi 5](#)

Rosie Hattersley on the Raspberry Pi website:

Solent University final-year student Josh Perryman reasoned that focusing his efforts on identifying a specific type of cyberthreat would be a practical use of machine learning, and also make a great excuse to finally try Raspberry Pi's capabilities in this field for himself. His Signal

Sentinel can detect jamming attacks on wirelessly connected devices including IoT hardware and even cars – an increasingly prevalent target for thieves. Josh envisages his Signal Sentinel being integrated with other systems which mitigate or prevent the attack.

...

The plan was to get Raspberry Pi to classify and passively detect radio frequency jamming signals. Josh would build a proof-of-concept model to demonstrate how effectively and efficiently machine learning could be used for the purpose. He selected Raspberry Pi 5 for its processing power and with an eye on planned future projects involving the AI+ HAT and Camera Module NoIR. Keen to keep build costs down, he began with an unbranded LCD that seemed to have similar capabilities to Waveshare's. However, Josh soon found out that this was a false economy: "the unbranded screen was quite cheap and caused some electrical issues, causing Raspberry Pi to turn off when [it] was connected. Changing this for a better-quality screen fixed this issue.

This is a cool project, especially for someone with no experience with radio technology. It's another good example of embedded Machine Learning (ML) used in radio technology.

###

Why [Connect Systems Is] Improving the DMR in the CS7000 M17 PLUS

Email from Connect Systems - Jerry Wanger KK6LFS:

Why are we improving the DMR in the CS7000 M17 PLUS and what are those first set of improvements?

What we have right now

The CS7000 M17 PLUS is the first new radio in a long time that was designed for a radical realignment of what the customers can expect. The basic premise was make a radio so powerful it can do things we have not even dreamed about yet.

The radio as designed is basically two radios in one. The first radio is a full featured M17 radio running under the OPEN RTX operating system. This operating system was designed by amateurs and written by amateurs and everything is open source. This framework will allow the community to support multiple protocols such as P25, Fusion and others.

The second radio is a full featured Analog and DMR radio with all the bells and whistles expected of the best DMR radio available. This radio uses a double conversion superhetrodyne design with front end varactor tuning to allow the radio to have the ultimate in sensitivity and selectivity. This radio will work in a high RF environment compared to the other primitive radios using direct conversion receivers.

Why the need for an improvement

The biggest problem users have right now is making code plugs. We are currently designing features in the radio that will make it easier to set up a channel within the radios and even the ability to automatically make a code plug.

There are radios that can take all the known repeaters and make a code plug based on your location. We will do that too, however, it has a problem. The known repeaters that was available last year may not be available this year and the new repeaters are not currently registered in the database.

We have a better solution. We will make a code plug at any location based on the activity of radios at that location.

Once you find a Digital repeater, you need to find which groups or private calls are used. If it is an Analog repeater, then you need to find which CTCSS tones or DCS codes are used. We have a solution for that also.

The other major problem is making a specific channel while you are traveling. While many of the other radios have the ability to make channels manually without a computer, it is difficult and time consuming. You have to go to multiple screens. We make it easy by doing everything on a single screen. This allows you to go to a HAM convention and make a channel in seconds.

What if all you know is the frequency of the channel but do not know the slot, color code, or group. We have a solution to that. You set your radio to the specified frequency, wait for a transmission, press one key and you can now speak back to them.

We have other APPS within the radio that will give you new features you never knew you needed.

How did we get the manufacturer to put in these features?

There are two issues working with the manufacturer whenever you want them to add features. The first problem is communication. Unless you speak fluent Mandarin Chinese, it is very hard to get them to understand new concepts. It is not just giving them a specification, it is getting them to understand the specification. If you cannot have a back and forth conversation, you cannot explain what you want. The second issue is time. You may have a great idea, but if it requires too much time to modify their code, it is not going to get done.

To minimize the time they require to implement the features, I have to understand their general [architecture] and make the routines so it does not change their [architecture]. Over the last few years I was able to get a good grasp of how they do things so I can now implement complicated features without much change to their basic structure.

The other thing I did was to convince them that I could write the routines myself without seeing their source code. This means I could write the basic routines and then when it comes to interfacing to their system, I tell them what I need and they write it. I never have to see their source code. In some cases they give me the definition of their routines without actually giving me their routines. In other cases I have them integrate their routines with mine. The important concept is they never have to understand what I am doing in totality. We just need to work on very small pieces together that we can both understand.

The first module is finished and the second one is almost finished. I am waiting for them to have some time so they can finish the second one and I am currently working on the third module.

The radio as of right now has been set up for 4000 channels and 500,000 contacts. You have to wait a little while for the CPS to work with the 500,000 contacts. The framework for all the modules are in place and the first module is fully functional. Over the next few months all the modules will be finished.

To comply with “[fair use](#)”, in a Zero Retries mention such as the above, I normally provide only an *excerpt* of information, and provide a link to the website for the full information. *But Connect Systems only sends emails with no “reference” website for the emails.* (In my opinion, they should do so, and I’ve offered that feedback to KK6LFS.)

The information in this most recent email from Connect Systems is *very Zero Retries Interesting*, not just because of the reference to M17, but also because it discusses the process of a radio manufacturer trying to bring innovative features into the Amateur Radio market. “This is how the sausage gets made.” Not being able to link to a website with this information, I elected to include the entire text of the Connect Systems email.

Leave a comment

Share

Comments Summary From Previous Issue

Comments from Zero Retries 0205:

- Caution that even with “Raspberry Pi inside” that FlexRadio units shouldn’t be considered user hackable.
- Admiration at the implementation of polar modulation in QRP Labs QMX+. I had intended to mention and explore that in this issue, but it’s just too full. Thus, queued for next issue.
- Agreement that Single Frequency Repeaters are a cool, interesting idea.

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Zero Retries Boilerplate

The [Zero Retries Store](#) is now open for business with quality Zero Retries branded merchandise and items being retired from Steve’s N8GNJ Labs.

These bits were handcrafted (by a mere human, not an Artificial Intelligence bot) in beautiful Bellingham ([The City of Subdued Excitement](#)), Washington, USA, and linked to the Internet via [Starlink Satellite Internet Access](#).

See the **Zero Retries Boilerplate** page for significant acknowledgements and other information relevant to Zero Retries. For new readers of Zero Retries, that page, and the **About Zero Retries** page has useful information to check out.

My ongoing *Thanks* to:

Tina Stroh KD7WSF for, well, *everything!*

Jack Stroh, Late Night Assistant Editor Emeritus

Shrek Stroh, Late Night Assistant Editor In training

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This issue released on 2025-06-13

Post Info (final draft):

- Words: ~14,462 (revised version - 14,565)
- Sentences: ~996 (revised version - 1,004)
- Reading time: ~66 minutes (revised version - 67 minutes)

Keywords for this Issue

Zero Retries 0206 dated 2025-06-13:

Amateur Radio, Amateur Radio Digital Communications, APRS, APRS Foundation, ARDC, Bruce Perens, Compute Module 4, Compute Module 5, Connect Systems, CS7000 M17 PLUS, **Data Communications**, Dan Maloney, **Digital Communications**, **Digital Voice**, DLARC, **DV**, EcoFlow River 3 Plus Wireless Boost Combo, FCC, Federal Communications Commission, FreeDV, Hackaday, **Ham Radio**, HAM RADIO Friedrichshafen Germany, Internet Archive, IP400, Jeff Geerling, Jerry Wanger, K6BP, K6KJN, Kay Savetz, KF0MYB, KK6LFS, M17, Machine Learning, Meteor Burst Communications, Meteor Scatter Communications, Meteorcomm, ML, N7DPM, **N8GNJ**, **Packet Radio**, Piotr Wilkoń, **Radio Technology**, RADE, Raspberry Pi, Repeaters, RTL-SDR, SCR, SDR, Single Channel Repeater, Single Pair Ethernet, Skyroof, Sorcerer Y Combinator, **Software Defined Radio**, **Software Defined Receiver**, SPE, SQ8L, Starlink, SteppIR, **Steve Stroh**, Substack, TDD, Time Domain Duplex, UPS, Uninterruptible Power Supply, VP-Digi

*Keywords in **Bold** are regular mentions in each issue.*

Footnotes for this Issue

To see the relevant sentence for the footnote, just click the footnote number.

[1](#)

Some exceptions such as FreeDV, and Opulent Voice.

[2](#)

Current Raspberry Pi 5 variants:

2GB - \$50

4GB - \$60

8GB - \$80

16GB - \$120

For someone who learned pidgin assembly language programming in a 4k bank of a timeshared Altair microcomputer (maxed out to a staggering 64k...) those capabilities and price points are just a nutty fantasy. Imagine what the Raspberry Pi 6 will be like, which is inevitably in the design process.

[3](#)

I keep re-learning that this isn't a quote from the Dr. Seuss book "Oh the Places You'll Go" as most of us "learned". Details at <https://quoteinvestigator.com/2016/07/25/smile/>.